PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2003-124396
(43)Date of publication of application : 25.04.2003

(51)Int.Cl. H01L 23/12
G01R 1/073
G01R 31/26
H01L 21/60
H01L 23/32
H01R 11/01
H01R 12/16

(21)Application number : 2001-317170
(22)Date of filing : 15.10.2001

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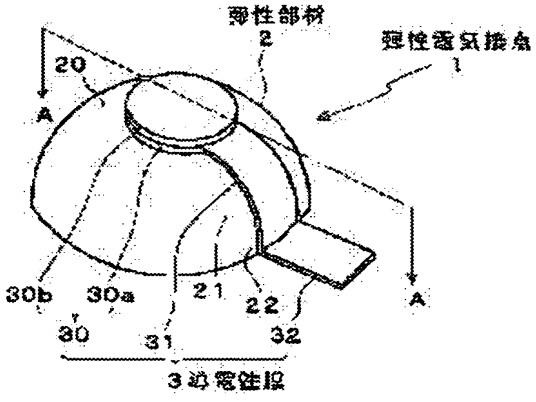
(54) ELASTIC ELECTRIC CONTACT

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an elastic electric contact in which a service life can be prolonged and an electric connection is surely enabled.
SOLUTION: An elastic electric contact 1 is composed of an elastic member 2 and a conductive film 3. Concretely, the elastic member 2 is formed by forming silicon into a semi-spherical shape, and the band-like conductive film 3 is stuck from the top end face 20 of the elastic member 2 along with its side face 21. The conductive film 3 is composed of a head 30, a body 31 and an extended part 32 integrally formed from titanium and palladium. Then, the head 30 is formed from a lower layer 30a and a gold plating upper layer 30b.



LEGAL STATUS

[Date of request for examination] 17.11.2003
[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]
* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] Elastic electric contact characterized by what it has an edge in the apical surface of the elastic member of an abbreviation semi-sphere configuration, and this elastic member, and results [from this apical surface] in the base side of an elastic member along the front face of an elastic member, and the band-like conductive film which extended to the method of outside [base] is provided for.
[Claim 2] Elastic electric contact characterized by what the thickness of the edge of the above-mentioned conductive film was set up for by 10 times [1 time to] the thickness of other parts in elastic electric contact according to claim 1.
[Claim 3] Elastic electric contact characterized by what meat omission of the base of the above-mentioned elastic member was performed, and the centrum was formed in the base concerned for in elastic electric contact according to claim 1 or 2.
[Claim 4] Elastic electric contact characterized by what the above-mentioned elastic member was formed for by silicone rubber in elastic electric contact according to claim 1 to 3.

[Translation done.]

* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the structure of elastic electric contact which can be used for a semi-conductor substrate, the circuit board, INTAPOZA, an IC socket, a bare chip checking socket, etc.
[0002]
[Description of the Prior Art] Conventionally, there is a technique given in JP,61-259548,A as this kind of elastic electric contact. Drawing 16 is the fragmentary sectional view showing this Prior art. In drawing 16 , signs 201,202,203 are a semi-conductor substrate, aluminum wiring, and an insulating layer, respectively, and elastic electric contact 210 is electrically connected to the aluminum wiring 202 of the semi-conductor substrate 201. Elastic electric contact 210 consists of a barrier layer 211 which vapor-deposited and formed aluminum and

nickel in the aluminum wiring 202 with vacuum evaporation technique, an elastic member 212 which piled silicone rubber in the abbreviation semi-sphere type by screen-stencil, and formed it on the barrier layer 211, and a conductive layer 213 as conductive film which gold-plated uniform thickness and was formed in all the front faces of an elastic member 212.

[0003] He is trying to plan positive electrical connection of elastic electric contact 210 and a land 221 with the elasticity of an elastic member 212 by making the semi-conductor substrate 201 and a glass substrate 220 approach, and pressing either the semi-conductor substrate 201 or the glass substrate 220 to the other side by this configuration, where elastic electric contact 210 and a land 221 are contacted.

[0004]

[Problem(s) to be Solved by the Invention] However, there are the following problems in above-mentioned conventional elastic electric contact 210. First, since the conductive layer 213 has covered all the front faces of an elastic member 212, a crack occurs in a conductive layer 213 and it is easy to wake up a faulty connection. That is, when elastic electric contact 210 is pressed on a land 221, positive electrical installation of elastic electric contact 210 and a land 221 is planned because a conductive layer 213 follows and deforms into an elastic member 212. however, the elastic modulus of a conductive layer 213 -- modulus ratio **** of an elastic member 212 -- it is remarkably small, and since it moreover has structure in which the conductive layer 213 covered all the front faces of an elastic member 212, at the time of press of elastic electric contact 210, a conductive layer 213 may follow, and may not deform into an elastic member 212, but a crack etc. may be generated. A conductive layer 213 is worn out and elastic electric contact 210 stops next, becoming useful for a short period of time. That is, although the semi-conductor substrate 201 is lowered to a perpendicular direction V and elastic electric contact 210 is contacted to a land 221, the semi-conductor substrate 201 moves to a horizontal direction H slightly after contact to elastic electric contact 210 and a land 221 actually. For this reason, contact partial 213a which is a part for the point of elastic electric contact 210 will be worn out by friction with a land 221. Since a conductive layer 213 is thin gold plate of uniform thickness at this time, contact partial 213a of a conductive layer 213 will be worn out by the fricative repeat for a short period of time. Consequently, there is a possibility that an elastic member 212 may become unreserved and elastic electric contact 210 may become unusable by contact partial 213a for a short period of time.

[0005] It was made in order that this invention might solve the technical problem mentioned above, and it aims at offering elastic electric contact in which protraction of a life and positive electrical installation are possible.

[0006]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, elastic electric contact concerning invention of claim 1 has an edge in the apical surface of the elastic member of an abbreviation semi-sphere configuration, and this elastic member, and resulted [from this apical surface] in the base side of an elastic member along the front face of an elastic member, and was considered as the band-like conductive film which extended to the method of outside [base], and the configuration to provide. By this configuration, where the conductive film of elastic electric contact is connected to electrodes, such as a semi-conductor substrate, if the base side of an elastic member contacts the point of installation and elastic electric contact to a semi-conductor substrate at the land of the circuit board etc., the edge of the conductive film will contact a land, and electrical installation of the circuit board and a semi-conductor substrate is planned. Since the conductive film is formed in band-like and has not covered the whole elastic member surface although the elastic member of elastic electric contact deforms if a semi-conductor substrate is pressed to a circuit board side, the conductive film follows and deforms into an elastic member.

[0007] Furthermore, invention of claim 2 is considered as the configuration which set up the thickness of the edge of the conductive film by 10 times [1 time to] the thickness of other parts in elastic electric contact according to claim 1. The prolonged activity corresponding to the thickness of an edge by the time it wears out the edge of the conductive film of elastic electric contact thoroughly by friction with the land of the circuit board etc. and an elastic member is exposed with this configuration is possible.

[0008] It has considered as the configuration which invention of claim 3 performed meat omission of the base of an elastic member in elastic electric contact according to claim 1 or 2, and formed the centrum in the base concerned especially. From that of this configuration, flexibility arises in the base side of an elastic member.

[0009] By the way, although the construction material of an elastic member and the conductive film is arbitrary, invention of claim 4 is considered as the configuration which formed the elastic member by silicone rubber in elastic electric contact according to claim 1 to 3 as the good example.

[0010]

[Embodiment of the Invention] Hereafter, the gestalt of implementation of this invention is explained with reference to a drawing.
(1st operation gestalt) Drawing 1 is the perspective view showing elastic electric contact concerning the 1st operation gestalt of this invention, and drawing 2 is the view A-A sectional view of drawing 1 . As shown in drawing, elastic electric contact 1 is equipped with an elastic member 2 and the conductive film 3, and becomes.
[0011] An elastic member 2 is what formed silicon in the semi-sphere configuration as the mold, and it adheres to the band-like conductive film 3 along the side face 21 from the apical surface 20.
[0012] The conductive film 3 consists of a head 30 (edge), a drum section 31, and the extension section 32, and lower layer 30a, the drum section 31, and the extension section 32 of a head 30 are formed in one of titanium and palladium.
[0013] It adheres the circle configuration to lower layer 30a of a head 30 on the apical surface 20 of nothing and an elastic member 2. And the laminating of the up layer 30b of isomorphism is carried out on this lower layer 30a. Besides, member 30b is formed of gold plate, and constitutes the head 30 with lower layer 30a.
[0014] The drum section 31 of the conductive film 3 is in the condition pulled out from nothing and lower layer 30a in band-like, and has reached the base 22 along the side face 21 of an elastic member 2. The extension section 32 is in the condition pulled out from the above-mentioned drum section 31, and only predetermined die length has extended to the way outside the elastic member 2. And only the thickness of upper part [thickness / of the drum section 31 of others / thickness / of a head 30 / or the extension section 32] layer 30b is thick. With this operation gestalt, thickness T of a head 30 was set up the twice of thickness t of a drum section 31 (extension section 32).
[0015] Next, the manufacture approach of elastic electric contact 1 of this operation gestalt is explained. Elastic electric contact 1 is manufactured through an elastic member formation process, a following conductive film formation process, and a following thickening process. Drawing 3 , drawing 4 , and drawing 5 are order process drawings showing an elastic member formation process, a conductive film formation process, and a thickening process, respectively.
[0016] First, in an elastic member formation process, as shown in (a) of drawing 3 , the mold 100 which has hole 100a of a semi-sphere configuration is prepared, and as shown in (b) of this drawing, a release agent 101 is applied to the front face of a mold 100. And after a release agent 101 dries, it is filled up with silicon 2' in hole 100a of a mold 100, and as shown in (c) of this drawing, as shown in (d) of this drawing, the insulating film 102 is stuck so that silicon 2' may be covered. After silicon 2"s solidifying and forming the elastic member 2 of a semi-sphere configuration after an appropriate time, an elastic member formation process is ended by exfoliating the insulating film 102 which the elastic member 2 fixed from a mold 100.
[0017] Next, in a conductive film formation process, as shown in (a) of drawing 4 , a shadow mask 103 is arranged on the elastic member 2 which fixed on the insulating film 102. (b) of drawing 4 R> 4 is the top view seen from the upper part of this drawing (a). As shown in this drawing, the hole 104 of the shape of a matchstick with round shape hole 104a and band-like hole 104b in a shadow mask 103 is drilled. Therefore, through a hole 104, by vapor-depositing titanium and palladium, as shown in (c) of drawing 4 , the conductive film 3 is formed on an elastic member 2. As shown in (d) of drawing 4 , lower layer 30a of the conductive film 3 is formed by the apical surface of an elastic member 2, and, specifically, a drum section 31 is formed by the side face of an elastic member 2. And the extension section 32 is formed on the insulating film 102, and a conductive film formation process is completed.
[0018] Finally, as a thickening process is shown in (a) of drawing 5 , and an elastic member 2 and the conductive film 3 are covered, a photoresist 105 is applied on the insulating film 102. And lower layer 30a of the conductive film 3 and a corresponding part are etched, and hole 105a is formed in (b) of this drawing so that it may be shown. (c) of drawing 5 is the top view seen from the upper part of (b) of this drawing. As shown in this drawing, hole 105a is set up lower layer 30a and in the shape of isomorphism. As shown in the top view (e) seen from (d) of this drawing, and the upper part of this drawing after an appropriate time, manual gold plate is performed through hole 105a of a photoresist 105, and a thickening process is ended by making up layer 30b adhere on lower layer 30a.
[0019] As mentioned above, after carrying out sequential execution of an elastic member formation process, a conductive film formation process, and the thickening process, as shown in (a) of drawing 6 , and (b) by removing a photoresist 105 at the last, elastic electric contact 1 which appeared on the insulating film 102 can be obtained.
[0020] Next, the example of an activity of the above-mentioned connector 1 is explained. Drawing 7 is the

sectional view showing the example which used elastic electric contact 1 for INTAPOZA. This INTAPOZA 110 has structure which installation and these elastic electric contact 1-1 were minded for elastic electric contact 1 (1-1, 1-2) of a couple, it minded [of the insulating film 102] through hole 102a of the insulating film 102 for 1-2, and was electrically open for free passage. That is, two or more through hole 102a in which the medial surface adhered to copper foil 102b is prepared in the predetermined part of the insulating film 102. And elastic electric contact 1-1 of a couple and 1-2 will be arranged in both sides by each through hole 102a soon, and the extension section 32 of each elastic electric contact 1 is electrically connected with copper foil 102b at it.

[0021] Drawing 8 is the sectional view showing the example which used INTAPOZA 110, in order to connect IC chip and the burn-in socket as a semi-conductor substrate. In drawing 8 , a sign 111 is IC chip and a sign 112 is a burn-in socket. If INTAPOZA 110 is contained in the burn-in socket 112 as shown in drawing, elastic electric contact 1-2 of the INTAPOZA 110 bottom will contact land 112a of the burn-in socket 112. And if the IC chip 111 is laid on INTAPOZA 110, elastic electric contact 1-1 of an INTAPOZA 110 upside will contact electrode 111a of the IC chip 111. If the IC chip 111 and the burn-in socket 112 are illustrated, twisted and stopped in this condition and it pinches by means of a spring etc., the IC chip 111 will descend and INTAPOZA 110 will be pressed. Since elastic electric contact 1-1 and 1-2 are compressed into an INTAPOZA 110 side by this to be shown in drawing 9 , according to the elastic force of the elastic member 2 of each elastic electric contact 1-1 (1-2), up layer 30b of the conductive film 3 of elastic electric contact 1-1 carries out a pressure welding to electrode 111a of the IC chip 111, and up layer 30b of elastic electric contact 1-2 carries out a pressure welding to land 112a of the burn-in socket 112. Consequently, electrode 111a and land 112a are open for free passage through copper foil 102b of elastic electric contact 1-1, the conductive film 3 of 1-2, and the insulating film 102, and the IC chip 111 and the burn-in socket 112 will connect electrically through INTAPOZA 110.

[0022] By the way, if the IC chip 111 descends, while the head 30 of the conductive film 3 of elastic electric contact 1-1 will be caudad pressed by electrode 111a, the head 30 of the conductive film 3 of elastic electric contact 1-2 is pressed up by land 112a. Since the conductive film 3 of elastic electric contact 1 has not covered the whole surface of an elastic member 2 at this time, it will follow and bend in deformation of an elastic member 2. That is, for example, supposing the conductive film 3 has covered the whole surface of an elastic member 2, the cross section of the conductive film 3 will become a configuration like an arch-like ends supporting beam, as shown in drawing 10 . For this reason, when the big lower part force F works, there is a possibility that the conductive film 3 may avoid and a crack may arise according to the hauling force by component-of-a-force Ftheta and Ftheta' of a tangential direction. On the other hand, since that cross section is carrying out a configuration like a half-arch-like cantilever as shown in drawing 11 , if the big lower part force F works, the hauling force by component-of-a-force Ftheta of that tangential direction will not be committed, but the conductive film 3 will only be caudad bent by the conductive film 3 of this operation gestalt. Thus, according to elastic electric contact 1 of this operation gestalt, since a crack does not arise on the conductive film 3 at the time of the press to elastic electric contact 1, the positive electrical installation by elastic electric contact 1 is possible.

[0023] Moreover, if the desorption to the burn-in socket 112 of the IC chip 111 is repeated, by the time it will wear most heads 30 out since thickness T of a head 30 is set up the twice of thickness t of a drum section 31 (extension section 32) as mentioned above although the head 30 of the conductive film 3 is worn out by friction of electrode 111a or land 112a and the point of an elastic member 2 will be exposed, the repeat of attachment and detachment of the count of considerable is required. Therefore, the life of this elastic electric contact 1 can be said to be very long compared with the life of above-mentioned conventional elastic electric contact 210.

[0024] (2nd operation gestalt) Drawing 12 is the perspective view showing elastic electric contact concerning the 2nd operation gestalt of this invention, and drawing 13 is the view B-B sectional view of drawing 12 . As elastic electric contact 1' of this operation gestalt is shown in drawing, it differs from the operation gestalt of the above 1st in that it has centrum 22a which carried out ****** of the base 22 of an elastic member 2 meat omission, and formed it. To the height of ****** of an elastic member 2, it cuts, ****** of base 22 base of an elastic member 2 is lacked, as shown in drawing 13 , and, specifically, centrum 22a is formed so that clearly from drawing 14 which shows the rear face of elastic electric contact 1'. Thus, according to elastic electric contact 1' of this operation gestalt, since it has centrum 22a in the base 22 of an elastic member 2, according to the magnitude of centrum 22a, flexibility will increase to an elastic member 2.

[0025] An example of the process about elastic electric contact 1' of this operation gestalt is explained to the last. Although elastic electric contact 1' of this operation gestalt is also manufactured through the elastic member formation process and the conductive film formation process which were shown in drawing 3 thru/or

drawing 5 , and a thickening process, the device has developed in the elastic member formation process. That is, as shown in (a) of drawing 15 , while being filled up with silicon 2' in hole 100a of a mold 100, the insulating film 102 with centrum 22a and photoresist 102c of isomorphism is stuck. Under the present circumstances, the insulating film 102 is stuck on a mold 100 so that photoresist 102c may enter in hole 100a of a mold 100. after an appropriate time — conductivity — the film — a formation process — thickening — a process — pass — drawing 15 — (— b —) — being shown — as — an elastic member — two — conductivity — the film — three — a photoresist — 102 — c — having had — elasticity — electric contact — one — ' — manufacturing — although — this — a condition — **** — a photoresist — 102 — c — remaining — **** — since — this — a photoresist — 102 — c — removing — things — drawing — 1515 — (— c —) — being shown — as — a centrum — 22 — a — having had — elasticity — electric contact — one — ' — it can manufacture . Since other configurations and the operation effectiveness are the same as the operation gestalt of the above 1st, the publication is omitted.

[0026] In addition, this invention is not limited to the above-mentioned operation gestalt, and various deformation and modification are possible for it within the limits of the summary of invention. For example, with the above-mentioned operation gestalt, although silicon was used as an elastic member 2, an elastic member 2 may be formed using urethane, rubber, etc. which have elasticity. Moreover, in the above-mentioned operation gestalt, although raw materials, such as lower layer 30a of the conductive film 3, were formed by titanium and palladium, it can also form with nickel or aluminum. Moreover, although ****** of up layer 30b was considered as gold plate with the above-mentioned operation gestalt, as long as it is not only this but a high conductivity metal, what kind of raw material is sufficient. Moreover, although the head 30 of the conductive film 3 was circularly set up with the above-mentioned operation gestalt, it is not the semantics limited to this. The polygon of a hexagon etc. is included in the configuration of a head 30. Moreover, with the above-mentioned operation gestalt, although thickness T of a head 30 was set up the twice of thickness t of a drum section 31 (extension section 32), not the semantics limited to this but thickness T of a head 30 can be set as the value between one to 10 times of thickness t of drum section 31 grade. Moreover, although titanium and palladium were vapor-deposited and the conductive film 3 was formed on the elastic member 2 through the hole 104 of a shadow mask 103 in the conductive film formation process with the operation gestalt of the above 1st, sputtering of titanium and the palladium can be carried out, and the conductive film 3 can also be formed on an elastic member 2. Moreover, although it cut and lacked to the height of ****** of an elastic member 2 and centrum 22a was formed with the operation gestalt of the above 2nd, the magnitude and the configuration of this centrum 22a are arbitrary. According to the degree of the flexibility desired to an elastic member 2, setting out of various magnitude or a configuration is possible.

[0027]

[Effect of the Invention] Since according to this invention the conductive film of elastic electric contact follows deformation of an elastic member and deforms as explained in detail above, the crack of the conductive film does not arise and there is outstanding effectiveness that the soundness of electrical installation improves.

[0028] Moreover, reinforcement of elastic electric contact can be attained by setting up the conductive thickness of the edge of elastic electric contact by 10 times [1 time to] the thickness of other parts.

[0029] Furthermore, the flexibility of whole elastic electric contact can be raised by performing meat omission of the base of an elastic member.

[Translation done.]

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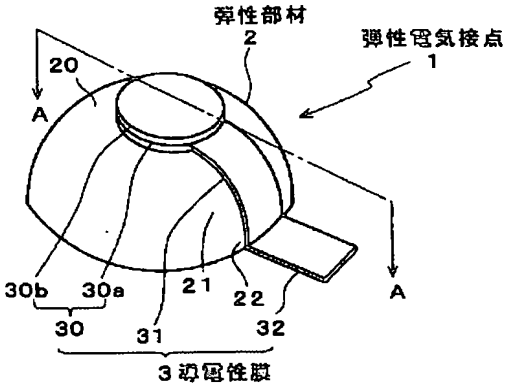
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective view showing elastic electric contact concerning the 1st operation gestalt of this invention.
[Drawing 2] It is the view A-A sectional view of drawing 1 .
[Drawing 3] It is order process drawing showing an elastic member formation process.
[Drawing 4] It is order process drawing showing more conductive ********.
[Drawing 5] It is order process drawing showing a thickening process.
[Drawing 6] It is the sectional view showing elastic electric contact which appeared on the insulating film.
[Drawing 7] It is the sectional view showing the example which used elastic electric contact for INTAPOZA.
[Drawing 8] It is the sectional view showing the example of an activity of INTAPOZA.
[Drawing 9] It is the sectional view showing the condition that IC chip and the burn-in socket connected electrically through INTAPOZA.
[Drawing 10] It is a mimetic diagram for explaining the crack phenomenon of the conductive film.
[Drawing 11] It is the mimetic diagram showing an operation of the conductive film of this operation gestalt.
[Drawing 12] It is the perspective view showing elastic electric contact concerning the 2nd operation gestalt of this invention.
[Drawing 13] It is the view B-B sectional view of drawing 12 .
[Drawing 14] It is the top view showing the rear face of electric contact.
[Drawing 15] It is process drawing showing the manufacture approach of elastic electric contact concerning the 2nd operation gestalt.
[Drawing 16] It is the fragmentary sectional view showing a Prior art.
[Description of Notations]
1 — Elastic electric contact 2 — Elastic member 3 — Conductive film 20 — Apical surface 21 — Side face 22 — Base 22a — Centrum 30 — Head 30a — Lower layer 30b — Up layer 31 — Drum section 32 — Extension section.

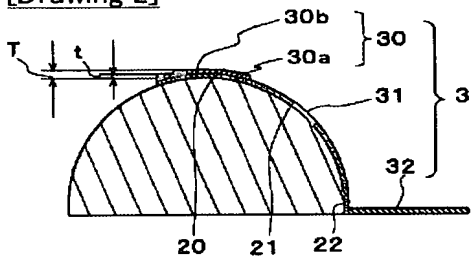
[Translation done.]

DRAWINGS

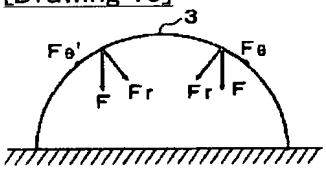
[Drawing 1]



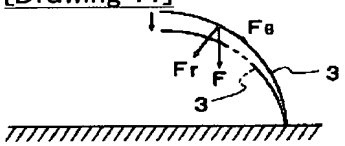
[Drawing 2]



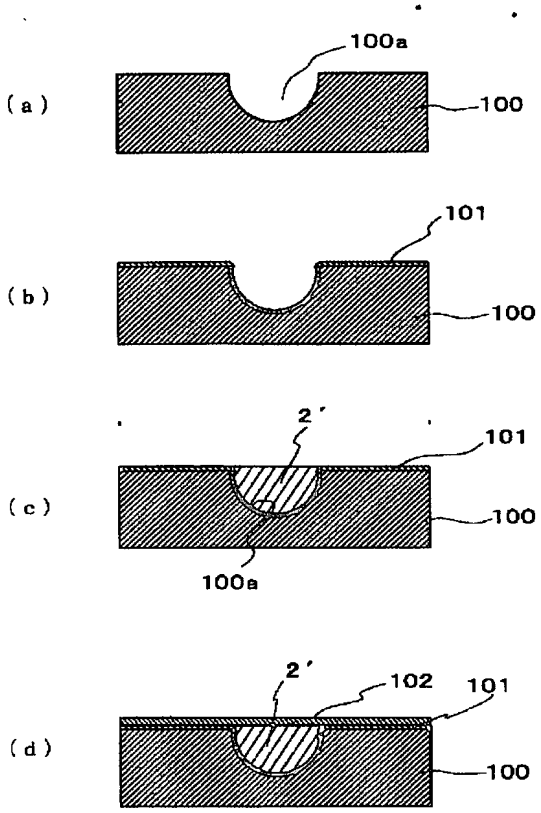
[Drawing 10]



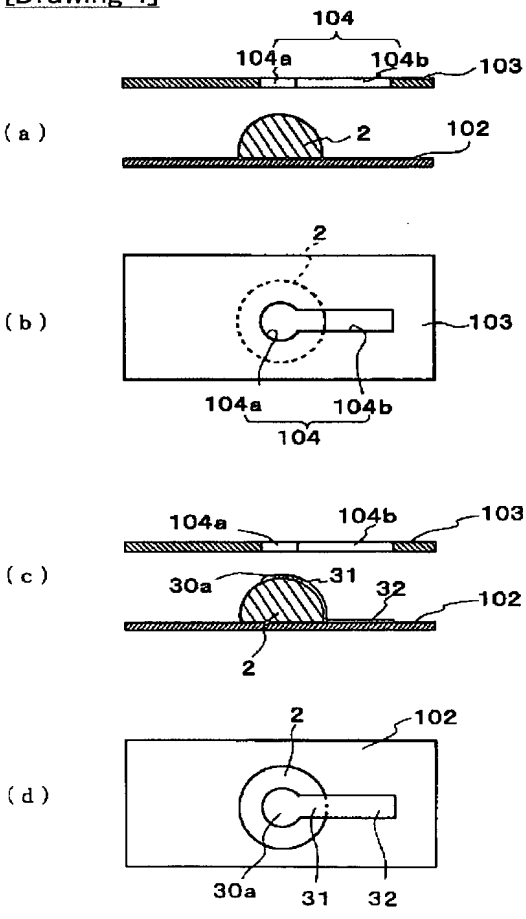
[Drawing 11]



[Drawing 3]

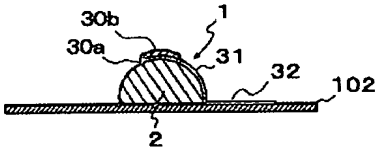


[Drawing 4]



[Drawing 6]

(a)



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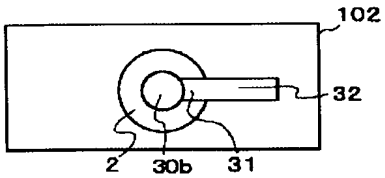
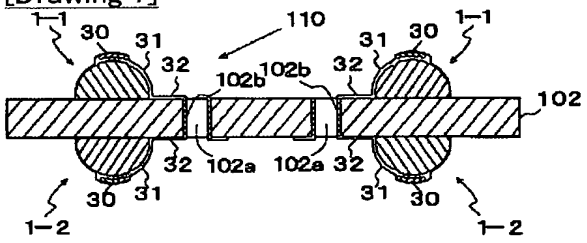
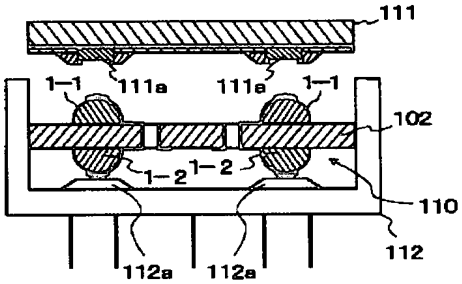


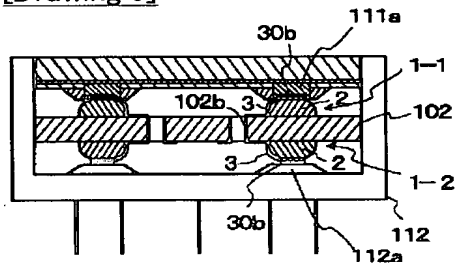
[Drawing 7]



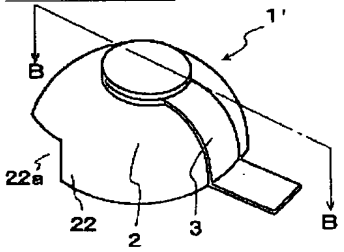
[Drawing 8]



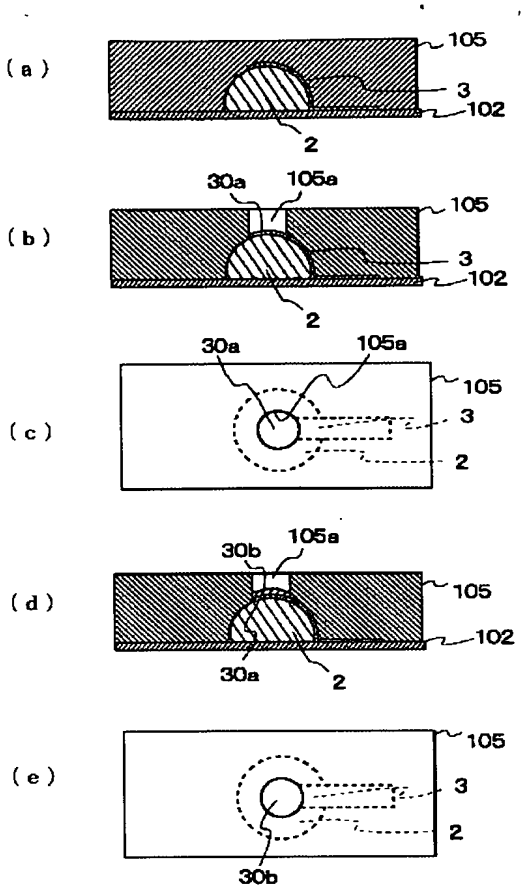
[Drawing 9]



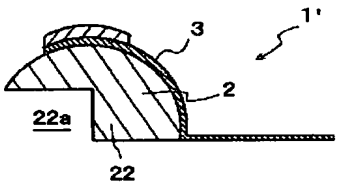
[Drawing 12]



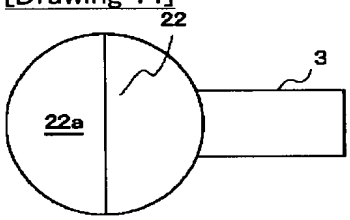
[Drawing 5]



[Drawing 13]



[Drawing 14]



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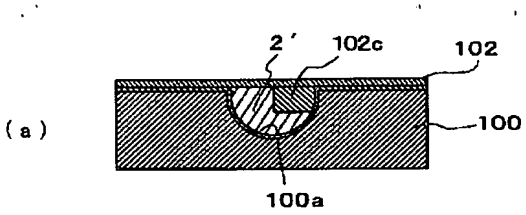

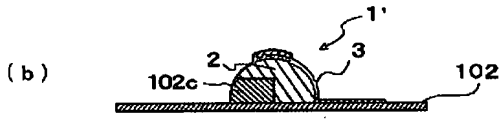

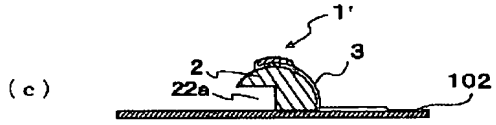

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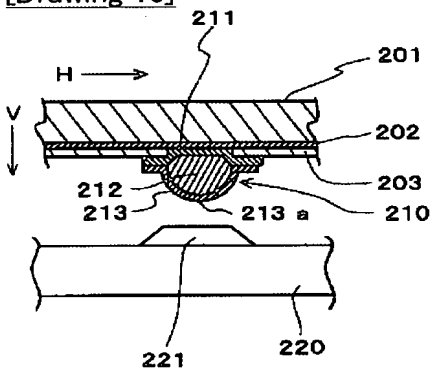

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号
特開2003－124396
（P2003－124396A）
(43)公開日　平成15年４月25日(2003.4.25)

(51)Int.Cl.[7]	識別記号	ＦＩ		テーマコード（参考）
Ｈ０１Ｌ　23/12	５０１	Ｈ０１Ｌ　23/12	５０１Ｚ	２Ｇ００３
Ｇ０１Ｒ　1/073		Ｇ０１Ｒ　1/073	Ｆ	２Ｇ０１１
31/26		31/26	Ｊ	５Ｅ０２３
Ｈ０１Ｌ　21/60		Ｈ０１Ｌ　23/32	Ｄ	
23/32		Ｈ０１Ｒ　11/01	５０１Ｊ	

審査請求　未請求　請求項の数４　ＯＬ　（全　８　頁）　最終頁に続く

(21)出願番号　特願2001－317170(P2001－317170)

(22)出願日　平成13年10月15日(2001.10.15)

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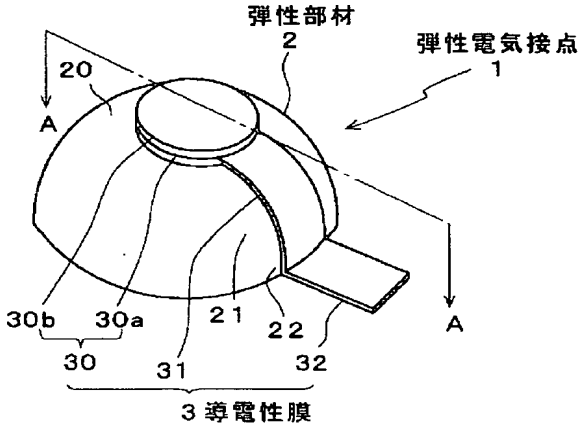
(54)【発明の名称】　弾性電気接点

(57)【要約】
【課題】　寿命の長期化と確実な電気的接続が可能な弾性電気接点を提供する。
【解決手段】弾性電気接点１を弾性部材２と導電性膜３で構成した。具体的には、シリコンを半球形状にして弾性部材２を形成し、弾性部材２の先端面２０から側面２１に沿って帯状の導電性膜３を付着した。導電性膜３は、チタン及びパラジウムによって一体に形成された頭部３０と胴部３１と延出部３２とよりなる。そして、頭部３０を下部層３０ａと金メッキの上部層３０ｂとで形成した。



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【特許請求の範囲】
【請求項１】　略半球形状の弾性部材と、
この弾性部材の先端面に端部を有し、且つこの先端面から弾性部材の表面に沿って弾性部材の基部側に至り、基部より外方に延出した帯状の導電性膜とを具備する、
ことを特徴とする弾性電気接点。
【請求項２】　請求項１に記載の弾性電気接点において、
上記導電性膜の端部の膜厚を他の部分の膜厚の１倍～１０倍に設定した、
ことを特徴とする弾性電気接点。
【請求項３】　請求項１または請求項２に記載の弾性電気接点において、
上記弾性部材の基部の肉抜きを行って当該基部に中空部を形成した、
ことを特徴とする弾性電気接点。
【請求項４】　請求項１ないし請求項３のいずれかに記載の弾性電気接点において、
上記弾性部材を、シリコンゴムで形成した、
ことを特徴とする弾性電気接点。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】この発明は、半導体基板，回路基板，インターポーザー，ＩＣソケット，及びベアチップ検査用ソケット等に用いることができる弾性電気接点の構造に関するものである。
【０００２】
【従来の技術】従来、この種の弾性電気接点として、特開昭６１－２５９５４８号記載の技術がある。図１６は、この従来の技術を示す部分断面図である。図１６において、符号２０１，２０２，２０３は、それぞれ半導体基板，アルミ配線，絶縁層であり、半導体基板２０１のアルミ配線２０２に弾性電気接点２１０が電気的に接続されている。弾性電気接点２１０は、アルミやニッケルを真空蒸着法によってアルミ配線２０２に蒸着して形成したバリヤー層２１１と、バリヤー層２１１上にシリコンゴムをスクリーン印刷により略半球式に盛って形成した弾性部材２１２と、弾性部材２１２の全表面に一様の厚さの金メッキを施して形成した導電性膜としての導電層２１３とで構成されている。
【０００３】かかる構成により、半導体基板２０１とガラス基板２２０とを接近させ、弾性電気接点２１０とランド２２１とを接触させた状態で、半導体基板２０１又はガラス基板２２０の一方を他方側に押圧することにより、弾性部材２１２の弾性によって、弾性電気接点２１０とランド２２１との確実な電気接続を図るようにしている。
【０００４】
【発明が解決しようとする課題】しかしながら、上記した従来の弾性電気接点２１０では、次のような問題がある。まず、導電層２１３が弾性部材２１２の全表面を覆っているので、導電層２１３に亀裂が発生して、接続不良を起こし易い。即ち、弾性電気接点２１０をランド２２１上に押圧したときに、導電層２１３が弾性部材２１２に追従して変形することで、弾性電気接点２１０とランド２２１との確実な電気的接続が図られる。しかし、導電層２１３の弾性率が弾性部材２１２の弾性率比べて著しく小さく、しかも、導電層２１３が弾性部材２１２の全表面を覆った構造になっているので、弾性電気接点２１０の押圧時に、導電層２１３が弾性部材２１２に追従して変形せず、亀裂などを発生する可能性がある。次に、導電層２１３が摩耗して弾性電気接点２１０が短期間で使い物にならなくなる。即ち、半導体基板２０１を垂直方向Ｖに下げて、弾性電気接点２１０をランド２２１に接触させるが、実際には、弾性電気接点２１０とランド２２１との接触後に、半導体基板２０１が僅かに水平方向Ｈに移動する。このため、弾性電気接点２１０の先端部分である接触部分２１３ａがランド２２１との摩擦によって摩耗することになる。このとき、導電層２１３が一様の厚さの薄い金メッキであるので、摩擦の繰り返しによって短期間で導電層２１３の接触部分２１３ａが摩耗してしまう。この結果、接触部分２１３ａで弾性部材２１２がむき出しになり、弾性電気接点２１０が短期間で使用不可能になってしまうおそれがある。
【０００５】この発明は上述した課題を解決するためになされたもので、寿命の長期化と確実な電気的接続が可能な弾性電気接点を提供することを目的とするものである。
【０００６】
【課題を解決するための手段】上記課題を解決するために、請求項１の発明に係る弾性電気接点は、略半球形状の弾性部材と、この弾性部材の先端面に端部を有し、且つこの先端面から弾性部材の表面に沿って弾性部材の基部側に至り、基部より外方に延出した帯状の導電性膜と具備する構成とした。かかる構成により、半導体基板等の電極に弾性電気接点の導電性膜を接続させた状態で、弾性部材の基部側を半導体基板に取り付け、弾性電気接点の先端部を回路基板のランドなどに接触させると、導電性膜の端部がランドに接触して、回路基板と半導体基板との電気的接続が図られる。半導体基板を回路基板側に押圧すると、弾性電気接点の弾性部材が変形するが、導電性膜が帯状に形成され、弾性部材全面を覆っていないので、導電性膜が弾性部材に追従して変形する。
【０００７】さらに、請求項２の発明は、請求項１に記載の弾性電気接点において、導電性膜の端部の膜厚を他の部分の膜厚の１倍～１０倍に設定した構成としてある。かかる構成により、回路基板のランド等との摩擦により弾性電気接点の導電性膜の端部が完全に摩耗して弾性部材が露出するまでに、端部の膜厚に対応した長期間の使用が可能である。

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【０００８】特に、請求項３の発明は、請求項１または請求項２に記載の弾性電気接点において、弾性部材の基部の肉抜きを行って当該基部に中空部を形成した構成としてある。かかる構成のより、弾性部材の基部側に柔軟性が生じる。

【０００９】ところで、弾性部材と導電性膜の材質は任意であるが、その好例として、請求項４の発明は、請求項１ないし請求項３のいずれかに記載の弾性電気接点において、弾性部材を、シリコンゴムで形成した構成としてある。

【００１０】

【発明の実施の形態】以下、この発明の実施の形態について図面を参照して説明する。

（第１の実施形態）図１は、この発明の第１の実施形態にかかる弾性電気接点を示す斜視図であり、図２は図１の矢視Ａ－Ａ断面図である。図に示すように、弾性電気接点１は、弾性部材２と導電性膜３を備えてなる。

【００１１】弾性部材２は、シリコンを半球形状に型とって形成したもので、その先端面２０から側面２１に沿って帯状の導電性膜３が付着されている。

【００１２】導電性膜３は、頭部３０（端部）と胴部３１と延出部３２とよりなり、頭部３０の下部層３０ａと胴部３１と延出部３２とが、チタン及びパラジウムによって一体に形成されている。

【００１３】頭部３０の下部層３０ａは、円形状をなし、弾性部材２の先端面２０の上に付着されている。そして、この下部層３０ａの上に同形の上部層３０ｂが積層されている。この上部層３０ｂは金メッキにより形成されており、下部層３０ａと共に頭部３０を構成している。

【００１４】導電性膜３の胴部３１は、帯状をなし、下部層３０ａから引き出された状態で、弾性部材２の側面２１に沿って基部２２に至っている。延出部３２は、上記胴部３１から引き出された状態で、弾性部材２の外方に所定長さだけ延出されている。そして、頭部３０の厚さが他の胴部３１や延出部３２の厚さよりも上部層３０ｂの厚さだけ厚くなっている。この実施形態では、頭部３０の厚さＴを胴部３１（延出部３２）の厚さｔの２倍に設定した。

【００１５】次に、この実施形態の弾性電気接点１の製造方法について説明する。弾性電気接点１は、次の弾性部材形成工程と導電性膜形成工程と増厚工程とを経て製造される。図３，図４，図５は、弾性部材形成工程，導電性膜形成工程，増厚工程をそれぞれ示す順工程図である。

【００１６】まず、弾性部材形成工程においては、図３の（ａ）に示すように、半球形状の穴１００ａを有する型１００を用意し、同図の（ｂ）に示すように、離型剤１０１を型１００の表面に塗布する。そして、離型剤１０１が乾燥した後に、同図の（ｃ）に示すように、シリコン２′を型１００の穴１００ａ内に充填し、同図の（ｄ）に示すように、絶縁フィルム１０２をシリコン２′を覆うように貼り付ける。しかる後、シリコン２′が固まって半球形状の弾性部材２を形成した後に、弾性部材２が固着した絶縁フィルム１０２を型１００から剥離することで、弾性部材形成工程を終了する。

【００１７】次に、導電性膜形成工程においては、図４の（ａ）に示すように、絶縁フィルム１０２に固着した弾性部材２の上にシャドウマスク１０３を配置する。図４の（ｂ）は、同図（ａ）の上方から見た平面図である。この図に示すように、シャドウマスク１０３は円形孔１０４ａと帯状孔１０４ｂとを有したマッチ棒状の孔１０４が穿設されている。従って、孔１０４を介して、チタン及びパラジウムを蒸着することで、図４の（ｃ）に示すように、導電性膜３が弾性部材２上に成膜される。具体的には、図４の（ｄ）に示すように、導電性膜３の下部層３０ａが弾性部材２の先端面に成膜され、胴部３１が弾性部材２の側面に成膜される。そして、延出部３２が絶縁フィルム１０２上に成膜されて、導電性膜形成工程が終了する。

【００１８】最後に、増厚工程においては、図５の（ａ）に示すように、弾性部材２及び導電性膜３を覆うようにして、フォトレジスト１０５を絶縁フィルム１０２上に塗布する。そして、同図の（ｂ）に示すように、導電性膜３の下部層３０ａと対応する部分をエッチングして、孔１０５ａを形成する。図５の（ｃ）は、同図の（ｂ）の上方から見た平面図である。この図に示すように、孔１０５ａは、下部層３０ａと同形状に設定されている。しかる後、同図の（ｄ）及びこの図の上方から見た平面図（ｅ）に示すように、フォトレジスト１０５の孔１０５ａを介し手金メッキを行い、上部層３０ｂを下部層３０ａ上に付着させることで、増厚工程は終了する。

【００１９】上記のように、弾性部材形成工程，導電性膜形成工程，増厚工程を順次実行した後、最後に、フォトレジスト１０５を除去することで、図６の（ａ）及び（ｂ）に示すように、絶縁フィルム１０２上に載った弾性電気接点１を得ることができる。

【００２０】次に、上記コネクタ１の使用例について説明する。図７は、弾性電気接点１をインターポーザに使用した例を示す断面図である。このインターポーザ１１０は、一対の弾性電気接点１（１－１，１－２）を絶縁フィルム１０２の両面に取り付け、これらの弾性電気接点１－１，１－２を絶縁フィルム１０２のスルーホール１０２ａを介して電気的に連通した構造になっている。すなわち、内側面に銅箔１０２ｂが付着されたスルーホール１０２ａが絶縁フィルム１０２の所定箇所に複数設けられている。そして、各スルーホール１０２ａに近傍両面に、一対の弾性電気接点１－１，１－２が配設され、各弾性電気接点１の延出部３２が銅箔１０２ｂと電

気的に接続されている。

【００２１】図８は、半導体基板としてのＩＣチップとバーンインソケットとを接続するために、インターポーザ１１０を用いた例を示す断面図である。図８において、符号１１１がＩＣチップであり、符号１１２がバーンインソケットである。図に示すように、インターポーザ１１０をバーンインソケット１１２内に収納すると、インターポーザ１１０の下側の弾性電気接点１－２がバーンインソケット１１２のランド１１２ａと接触する。そして、ＩＣチップ１１１をインターポーザ１１０の上に載置すると、インターポーザ１１０の上側の弾性電気接点１－１がＩＣチップ１１１の電極１１１ａに接触する。この状態で、ＩＣチップ１１１とバーンインソケット１１２とを図示しない抑えバネなどで挟持すると、ＩＣチップ１１１が下降してインターポーザ１１０を押圧する。これにより、図９に示すように、弾性電気接点１－１，１－２がインターポーザ１１０側に圧縮されるので、各弾性電気接点１－１（１－２）の弾性部材２の弾性力によって、弾性電気接点１－１の導電性膜３の上部層３０ｂがＩＣチップ１１１の電極１１１ａに圧接し、弾性電気接点１－２の上部層３０ｂがバーンインソケット１１２のランド１１２ａに圧接する。この結果、電極１１１ａとランド１１２ａとが弾性電気接点１－１，１－２の導電性膜３及び絶縁フィルム１０２の銅箔１０２ｂを介して連通し、ＩＣチップ１１１とバーンインソケット１１２とがインターポーザ１１０を介して電気的に接続された状態になる。

【００２２】ところで、ＩＣチップ１１１が下降すると、弾性電気接点１－１の導電性膜３の頭部３０が電極１１１ａによって下方に押圧されると共に、弾性電気接点１－２の導電性膜３の頭部３０がランド１１２ａによって上方に押圧される。このとき、弾性電気接点１の導電性膜３が弾性部材２の全面を被覆していないので、弾性部材２の変形に追従して撓むことになる。すなわち、例えば、導電性膜３が弾性部材２の全面を覆っているとすると、導電性膜３の断面は、図１０に示すように、アーチ状の両端支持梁のごとき形状になる。このため、大きな下方力Ｆが働くと、接線方向の分力Ｆθ，Ｆθ’とによる引っ張り力によって、導電性膜３が避けて亀裂が生じるおそれがある。これに対して、この実施形態の導電性膜３では、その断面が、図１１に示すように、半アーチ状の片持ち梁のような形状をしているので、大きな下方力Ｆが働くと、その接線方向の分力Ｆθによる引っ張り力は働かず、導電性膜３が下方に撓むだけである。このように、この実施形態の弾性電気接点１によれば、弾性電気接点１への押圧時に導電性膜３に亀裂が生じることがないので、弾性電気接点１による確実な電気的接続が可能である。

【００２３】また、ＩＣチップ１１１のバーンインソケット１１２への脱着を繰り返すと、導電性膜３の頭部３０が電極１１１ａやランド１１２ａの摩擦によって摩耗するが、上記のように、頭部３０の厚さＴが胴部３１（延出部３２）の厚さｔの２倍に設定されているので、頭部３０の大部分が摩耗して弾性部材２の先端部が露出するまでには、相当回数の着脱の繰り返しが必要である。従って、この弾性電気接点１の寿命は、上記した従来の弾性電気接点２１０の寿命に比べてきわめて長いといえる。

【００２４】（第２の実施形態）図１２は、この発明の第２の実施形態にかかる弾性電気接点を示す斜視図であり、図１３は図１２の矢視Ｂ－Ｂ断面図である。この実施形態の弾性電気接点１’は、図に示すように、弾性部材２の基部２２の略半部を肉抜きして形成した中空部２２ａを有している点が、上記第１の実施形態と異なる。具体的には、弾性電気接点１’の裏面を示す図１４から明らかなように、弾性部材２の基部２２底面の略半部を、図１３に示すように、弾性部材２の略半部の高さまで切り欠いて、中空部２２ａを形成している。このように、この実施形態の弾性電気接点１’によれば、弾性部材２の基部２２に中空部２２ａを有しているので、中空部２２ａの大きさに応じて、弾性部材２に柔軟性が増加することになる。

【００２５】最後に、この実施形態の弾性電気接点１’に関する製法の一例を説明しておく。この実施形態の弾性電気接点１’も、図３ないし図５に示した弾性部材形成工程と導電性膜形成工程と増厚工程とを経て製造されるが、弾性部材形成工程において工夫が高じられている。即ち、図１５の（ａ）に示すように、シリコン２’を型１００の穴１００ａ内に充填すると共に、中空部２２ａと同形のフォトレジスト１０２ｃを有した絶縁フィルム１０２を貼り付ける。この際、フォトレジスト１０２ｃが型１００の穴１００ａ内に入り込むように、絶縁フィルム１０２を型１００に貼り付ける。しかる後、導電性膜形成工程と増厚工程とを経て、図１５の（ｂ）に示すように、弾性部材２と導電性膜３とフォトレジスト１０２ｃとを有した弾性電気接点１’を製造するが、この状態では、フォトレジスト１０２ｃが残っているので、このフォトレジスト１０２ｃを除去することで、図１５（ｃ）に示すように、中空部２２ａを有した弾性電気接点１’を製造することができる。その他の構成，作用効果は上記第１の実施形態と同様であるので、その記載は省略する。

【００２６】なお、この発明は、上記実施形態に限定されるものではなく、発明の要旨の範囲内において種々の変形や変更が可能である。例えば、上記実施形態では、弾性部材２としてシリコンを用いたが、弾性を有するウレタンやゴム等を用いて弾性部材２を形成しても良い。また、上記実施形態では、導電性膜３の下部層３０ａ等の素材をチタン及びパラジウムで形成したが、ニッケルやアルミニウムで形成することもできる。また、上記実

施形態では、上部層３０ｂの素材をを金メッキとしたが、これに限らず、高導電性金属であれば、いかなる素材でも良い。また、上記実施形態では、導電性膜３の頭部３０を円形に設定したが、これに限定する意味ではない。頭部３０の形状には、六角形などの多角形を含む。また、上記実施形態では、頭部３０の厚さＴを胴部３１（延出部３２）の厚さｔの２倍に設定したが、これに限定する意味ではなく、頭部３０の厚さＴを胴部３１等の厚さｔの１～１０倍の間の値に設定することができる。また、上記第１の実施形態では、導電性膜形成工程において、シャドウマスク１０３の孔１０４を介して、チタン及びパラジウムを蒸着して、導電性膜３を弾性部材２上に成膜したが、チタン及びパラジウムをスパッタリングして導電性膜３を弾性部材２上に成膜することもできる。また、上記第２の実施形態では、弾性部材２の略半部の高さまで切り欠いて、中空部２２ａを形成したが、この中空部２２ａの大きさや形状は任意である。弾性部材２に対して望まれる柔軟性の度合いに応じて、種々の大きさや形状の設定が可能である。

【００２７】

【発明の効果】以上詳しく説明したように、この発明によれば、弾性電気接点の導電性膜が、弾性部材の変形に追従して変形するので、導電性膜の亀裂が生じることがなく、電気的接続の確実性が向上するという優れた効果がある。

【００２８】また、弾性電気接点の端部の導電性膜厚を他の部分の膜厚の１倍～１０倍に設定することにより、弾性電気接点の長寿命化を図ることができる。

【００２９】さらに、弾性部材の基部の肉抜きを行うことで、弾性電気接点全体の柔軟性を向上させることができる。

＊【図面の簡単な説明】

【図１】この発明の第１の実施形態にかかる弾性電気接点を示す斜視図である。

【図２】図１の矢視Ａ－Ａ断面図である。

【図３】弾性部材形成工程を示す順工程図である。

【図４】導電性膜形成工程示す順工程図である。

【図５】増厚工程を示す順工程図である。

【図６】絶縁フィルム上に載った弾性電気接点を示す断面図である。

【図７】弾性電気接点をインターポーザに使用した例を示す断面図である。

【図８】インターポーザの使用例を示す断面図である。

【図９】ＩＣチップとバーンインソケットとがインターポーザを介して電気的に接続した状態を示す断面図である。

【図１０】導電性膜の亀裂現象を説明するための模式図である。

【図１１】本実施形態の導電性膜の作用を示す模式図である。

【図１２】この発明の第２の実施形態にかかる弾性電気接点を示す斜視図である。

【図１３】図１２の矢視Ｂ－Ｂ断面図である。

【図１４】電気接点の裏面を示す平面図である。

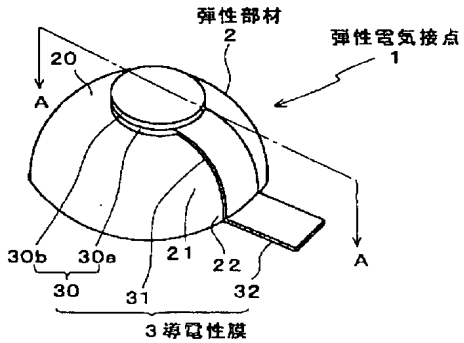
【図１５】第２の実施形態に係る弾性電気接点の製造方法を示す工程図である。

【図１６】従来の技術を示す部分断面図である。

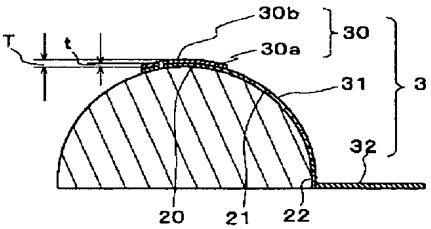
【符号の説明】

１…弾性電気接点、　２…弾性部材、　３…導電性膜、　２０…先端面、　２１…側面、　２２…基部、　２２ａ…中空部、　３０…頭部、　３０ａ…下部層、　３０ｂ…上部層、　３１…胴部、　３２…延出部。

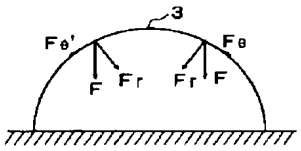
【図１】



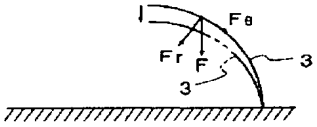
【図２】



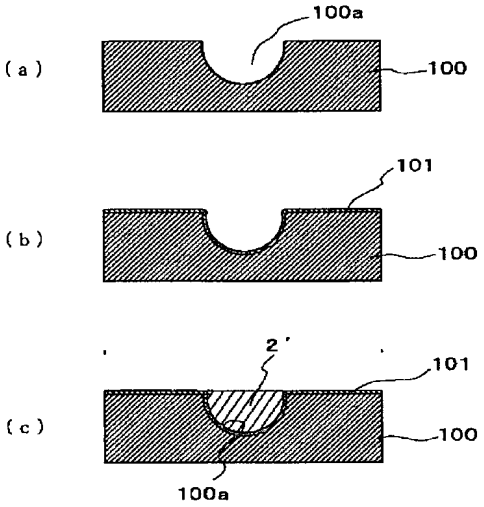
【図１０】



【図１１】



【図３】



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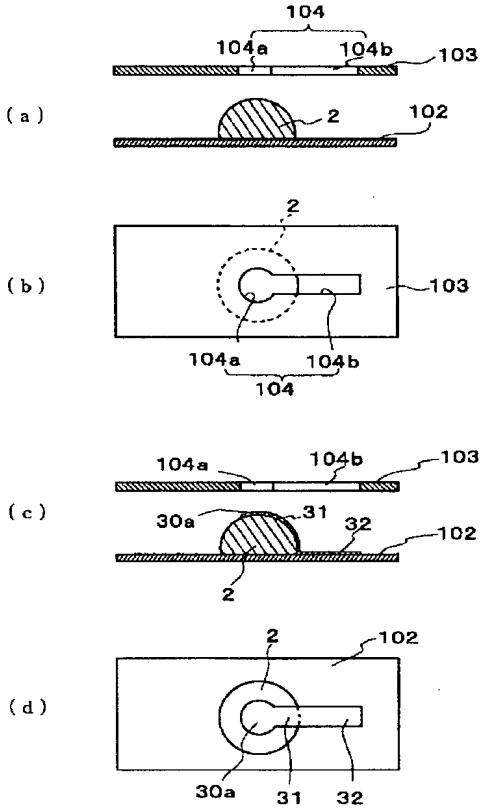

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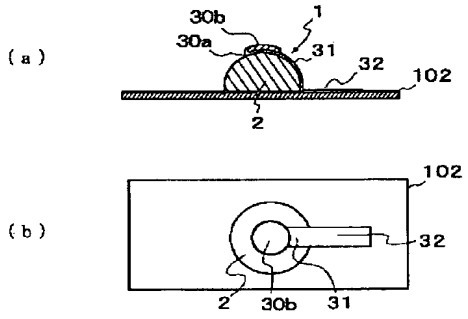

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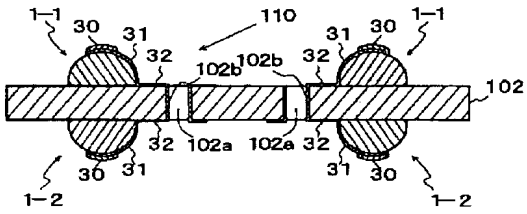

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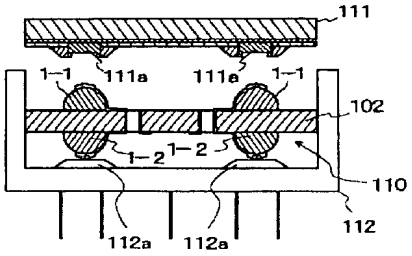

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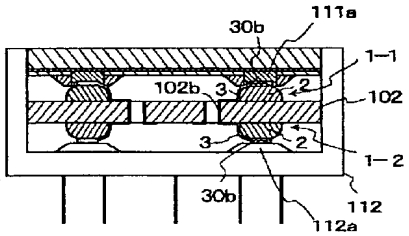
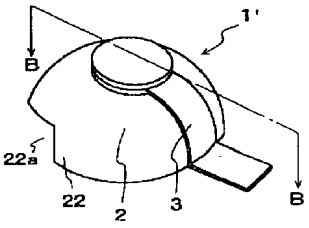


【図１２】



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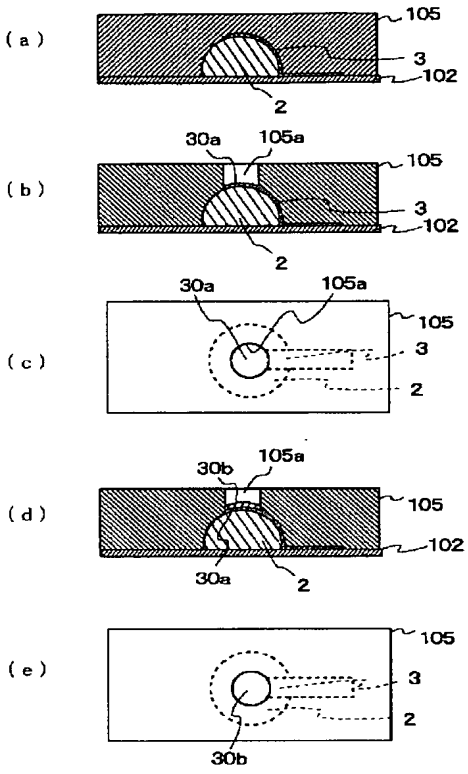

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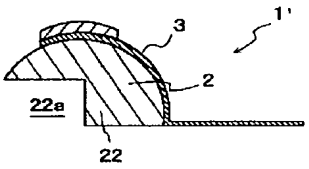

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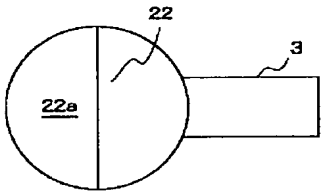

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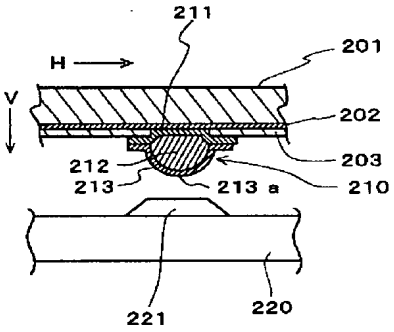

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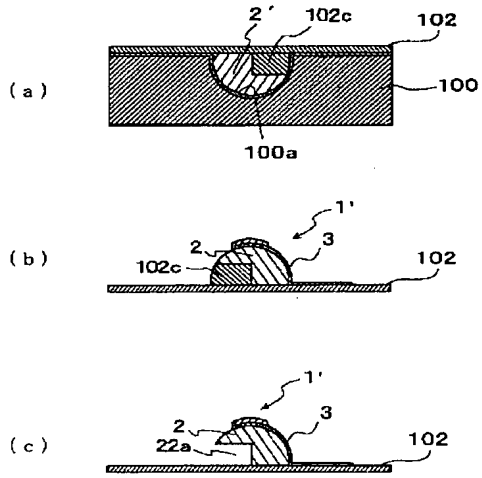

フロントページの続き

(51)Int.Cl.'		識別記号	F I		テーマコード（参考）
Ｈ０１Ｒ	11/01	５０１	Ｈ０１Ｌ	21/92	６０３Ａ
	12/16		Ｈ０１Ｒ	23/68	３０３Ｅ

Ｆターム(参考)　2G003 AA07 AD09 AG01 AG03 AG08
AG12 AG20 AH05
2G011 AA03 AA15 AA21 AB06 AB08
AC14 AE01 AE03 AF02 AF07
5E023 AA05 AA16 BB18 BB21 CC22
DD26 EE18 EE32 HH05